United States
Environmental Protection
Agency

Environmental
Sciences Division
P.O. Box 93478
Las Vegas, NV 89193-3478

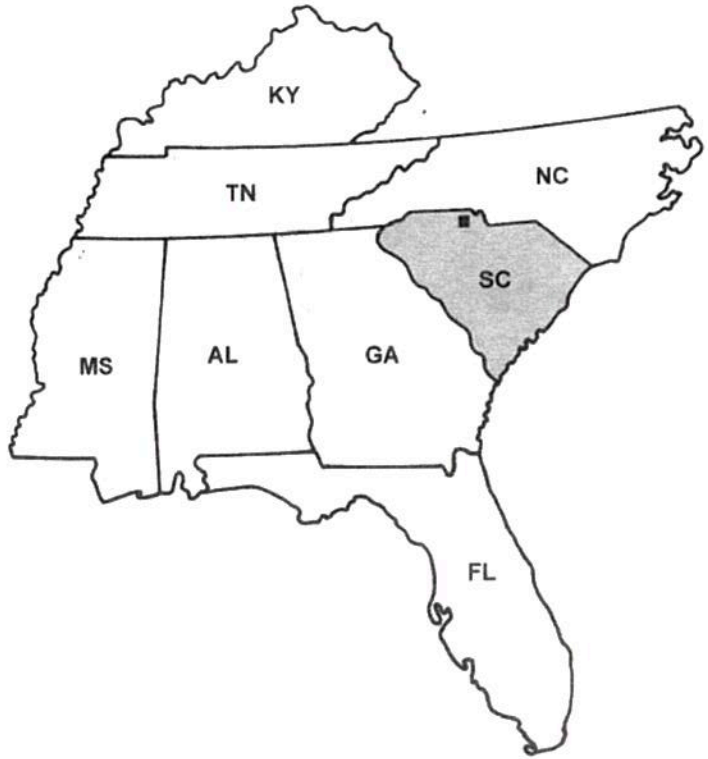
TS-PIC-20304515S
March 2003

Research and Development

EPA

AERIAL PHOTOGRAPHIC ANALYSIS OF HENRY'S KNOB SITE
Clover, South Carolina

EPA Region 4



TS-PIC-20304515S
March 2003

AERIAL PHOTOGRAPHIC ANALYSIS OF HENRY'S KNOB SITE

Clover, South Carolina

by

W. M. Mack
Environmental Services
Lockheed Martin Services
Las Vegas, Nevada 89119

Contract No. 68-D-00-267

Work Assignment Manager

J. L. Bozik
Landscape Ecology Branch
Environmental Sciences Division
Las Vegas, Nevada 89193-3478

ENVIRONMENTAL SCIENCES DIVISION
NATIONAL EXPOSURE RESEARCH LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
LAS VEGAS, NEVADA 89193-3478

NOTICE

This document has undergone a technical and quality control/assurance review and has been approved for publication by personnel of the U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, Landscape Ecology Branch at Las Vegas, Nevada. It is for internal Agency use and distribution only.

ABSTRACT

This report presents the results of an aerial photographic analysis of the Henry's Knob site, a former mine and mill operation, located approximately 3.7 kilometers (2.3 miles) northwest of Clover, South Carolina. For this analysis, nine dates of historical aerial photographs, spanning the period from 1941 through 1981, were reviewed, seven of which are included in this report. The Region 4 Office of the U.S. Environmental Protection Agency (EPA) requested this aerial photographic analysis support under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to develop field sampling strategies and aid field investigators at this facility.

The results of this historical photographic analysis revealed that the Henry's Knob site consisted of woodland in 1941 and by 1949 an access roadway had been constructed between State Route 508 and the summit of Henry's Knob. Excavation activity was also visible as was a mill complex, which had been constructed on the southwest hillside of Henry's Knob. The 1954, 1959, 1964, and 1970 photographs revealed the presence of an open pit mine that had been systematically enlarged and the volume of both associated spoil piles and tailings deposits increased during this time period. In addition as mining and milling operations expanded, impoundments were constructed downhill from the tailings deposits. Over time signs of erosion were noted in the probable tailings deposits and, by 1981 the mill complex had been dismantled and the spoil piles had become partially revegetated.

The EPA Environmental Sciences Division, Landscape Ecology Branch in Las Vegas, Nevada, prepared this report for the EPA Region 4 Hazardous Waste Management Division in Atlanta, Georgia, and the EPA Office of Emergency and Remedial Response in Washington, D.C.

CONTENTS

FIGURES

INTRODUCTION

This report presents the results of an historical aerial photographic analysis of the Henry's Knob site (CERCLIS ID #SCN000407376) located approximately 3.7 kilometers (2.3 miles) northwest of Clover, York County, South Carolina (Figures 1 and 2). For this analysis historical aerial photographs spanning the period from 1941 through 1981 were used. This report includes seven selected dates of photographs that document past conditions and waste disposal activities observed at this facility.

The Region 4 Office of the U.S. Environmental Protection Agency (EPA) requested this aerial photographic analysis support under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in order to develop new field sampling strategies and to aid in field investigations at this kyanite mine site. Previous field sampling studies have revealed elevated levels of barium, chromium, cobalt, magnesium, nickel, and zinc in the site's groundwater. Surface soil samples indicate elevated levels of arsenic, copper, lead, and mercury in addition to the metal contaminates identified in the groundwater. Elevated metal concentrations were also found in off-site private wells which indicates that groundwater in the area may have been affected as a result of past operations at the mine (EPA, 2003).

The following is an overview of the history of Henry's Knob kyanite mining operations (HPCPNH, 2003). From 1947 to 1970, an open pit mine at Henry's Knob was excavated for the extraction of kyanite, an aluminum silicon oxide used in the manufacture of ceramic bricks and other high temperature materials. As the mother rock was crushed and washed, insoluble kyanite crystals floated to the surface of the water and were skimmed off, with the tailings flowing away to form huge sterile deltas down slope from Henry's Knob. When kyanite mining stopped in 1970 a seven-acre, highly acidic pond was a prominent feature on the site. Efforts to reclaim the area through replanting and the spreading of lime to de-acidify the soil took place in subsequent years.

The following is a general description of kyanite mining and the benefaction/milling processes, adapted from *Geology of Kyanite* by D. Radcliffe, that were available during the time period in which the Henry's Knob facility was in operation. Although it is not certain all such operations took place at Henry's Knob this description is provided for background purposes. Mining was by open pit using percussion equipment and explosives. Loosened ore was loaded onto trucks and transported to primary crushers. The resulting coarse, crushed ore was often stockpiled prior to further processing. The stockpiles crushed ore was fed by conveyors into rod mills for finer crushing and classification, and then fed into a flotation plant. During the flotation process, insoluble materials were removed from the fine particles of ore in a process called "desliming." Next, the ore was conditioned with either acidic or basic chemical reagents for the removal of unwanted minerals. Upon the removal of these unwanted minerals, the remaining kyanite slurry was further processed via reconditioning with sulfuric acid and petroleum sulfonate, followed by counter-current flotation circuitry and magnetics. The final kyanite product was put through dewatering tanks and dryers before reaching a bagging house, where it was packaged, (EPA 2003).

This photographic analysis determined that in 1941 the Henry's Knob site consisted of woodland and no excavation activity or roadways were observed. By 1949 an access roadway had been constructed to the rock escarpment summit of Henry's Knob and excavation activity was visible. The buildings of a mill complex had also been constructed on the southwest hillside of Henry's Knob. By 1954 an open pit mine was visible and spoil piles had been deposited along the rim of the pit. Between 1959 and 1970 the open pit mine had been continually enlarged and the volume of both the spoil piles and the tailings deposits had increased. By 1964 an impoundment was constructed on the west side of State Route 508 and the areal extent of the probable tailings deposits had expanded to the northwest and north of the mill complex, while additional impoundments had been constructed downhill from these probable tailings deposits. By 1964 signs of erosion were noted on the probable tailings deposits. By 1981 the open pit mine appeared inactive, the mill complex had been dismantled, and the spoil piles had become partially revegetated. The probable tailings deposits; however, appeared to lack revegetation and continued to show signs of erosion.

The mining and milling operations observed at Henry's Knob occupied continually expanded areas over the time period of this analysis. Consequently a site boundary is not annotated on the photographs. The boundary shown on Figure 2 approximates the site at its greatest extent.

A Glossary, defining features or conditions identified in this report, follows the Photographic Analysis section. Sources for all maps, aerial photographs, and collateral data used in the production of this report are listed in the References section. A list of all aerial photographs that were identified and evaluated for potential application to this study can be obtained by contacting the EPA Work Assignment Manager. Historical aerial photographs used in the analysis of this site have been digitally scanned and printed for use in this report. A transparent overlay with interpretative data is affixed to each of the digital prints. See the Methodology section for a discussion of the scanning and printing procedures.

The EPA Environmental Sciences Division, Landscape Ecology Branch in Las Vegas, Nevada, prepared this report for the EPA Region 4 Hazardous Waste Management Division in Atlanta, GA, and the EPA Office of Emergency and Remedial Response in Washington, D.C.

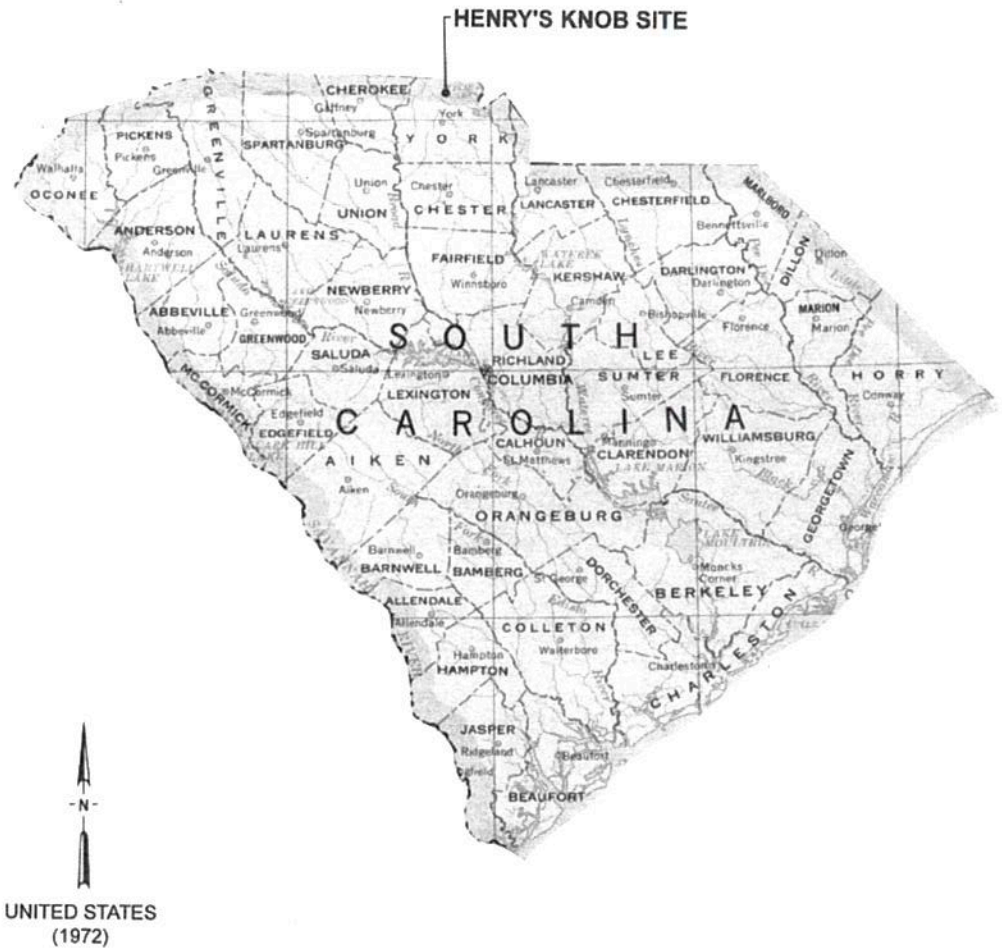


Figure 1. Study area location map, South Carolina (USGS, 1972). Approximate scale 1:2,500,000.

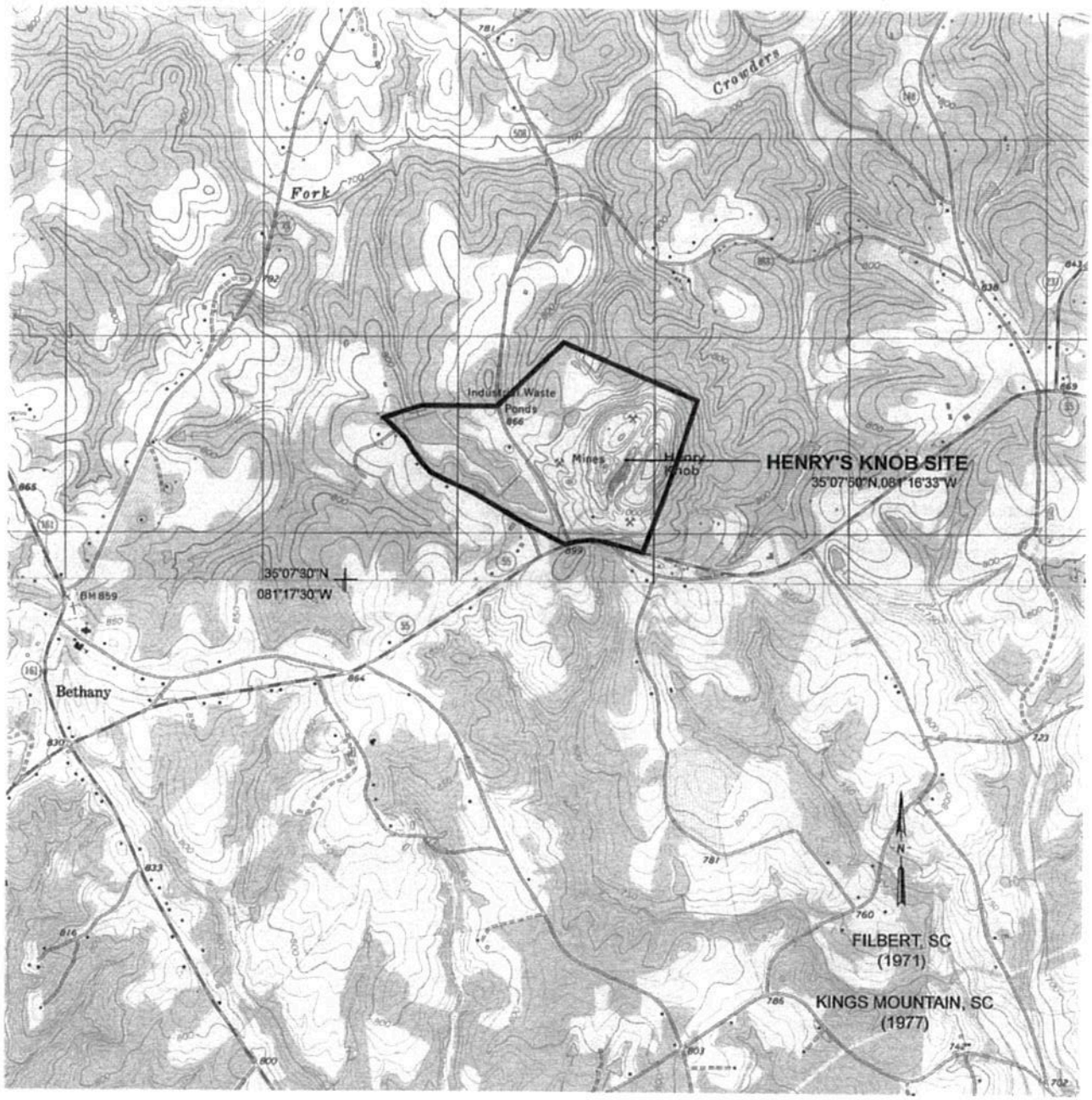


Figure 2. Local study area location map, Filbert, South Carolina (USGS, 1971), and Kings Mountain, South Carolina (USGS, 1977). Approximate scale 1:24,000.

METHODOLOGY

This report was prepared using a standard methodology that includes the following steps:

- data identification and acquisition,
- photographic analysis and interpretation, and
- graphics and text preparation.

These steps are described below. Subsections also address details related to specific kinds of analyses that may be required to identify environmental features such as surface drainage and wetlands. All operational steps and processes used to perform this work (including data identification and acquisition, photographic analysis and interpretation, and graphics and text preparation) adhere to strict QA/QC guidelines and standard operating procedures (SOPs). These guidelines and procedures are documented in the Master Quality Assurance Project Plan (QAPP) prepared for Remote Sensing Support Services Contract No. 68-D-00-267 (LMS, 2002).

Data identification and acquisition included a search of government and commercial sources of historical aerial film for the study area. Photographs with appropriate spatial and temporal resolution and image quality were identified for acquisition. In addition, U.S. Geological Survey (USGS) topographic maps were obtained to show the study area location and to provide geographic and topographic context.

To conduct this analysis, the analyst examined diapositives (transparencies) of historical aerial photographs showing the study area. Diapositives are most often used for analysis instead of prints because the diapositives have superior photographic resolution. They show minute details of significant environmental features that may not be discernible on a paper print.

A photographic analyst uses a stereoscope to view adjacent, overlapping pairs of diapositives on a backlit light table. In most cases, the stereoscope

is capable of various magnifications up to 60 power. Stereoscopic viewing involves using the principle of parallax (observing a feature from slightly different positions) to observe a three-dimensional representation of the area of interest. The stereoscope enhances the photo interpretation process by allowing the analyst to observe vertical as well as horizontal spatial relationships of natural and cultural features.

The process of photographic analysis involves the visual examination and comparison of many components of the photographic image. These components include shadow, tone, color, texture, shape, size, pattern, and landscape context of individual elements of a photograph. The photo analyst identifies objects, features, and "signatures" associated with specific environmental conditions or events. The term "signature" refers to a combination of components or characteristics that indicate a specific object, condition, or pattern of environmental significance. The academic and professional training, photo interpretation experience gained through repetitive observations of similar features or activities, and deductive logic of the analyst as well as background information from collateral sources (e.g., site maps, geologic reports, soil surveys) are critical factors employed in the photographic analysis.

The analyst records the results of the analysis by using a standard set of annotations and terminology to identify objects and features observed on the diapositives. Significant findings are annotated on overlays attached to the photographic or computer-reproduced prints in the report and discussed in the accompanying text. Annotations that are self-explanatory may not be discussed in the text. The annotations are defined in the legend that accompanies each print and in the text when first used.

Objects and features are identified in the graphics and text according to the analyst's degree of confidence in the evidence. A distinction is made between certain, probable, and possible identifications. When the analyst believes the identification is unmistakable (certain), no qualifier is used. Probable is used when a limited number of discernible characteristics allow the analyst to be reasonably sure of a particular identification. Possible is used when only a few characteristics are discernible, and the analyst can only infer an identification.

The prints in this report have been reproduced, either by photographic or computer methods, from the original film. Reproductions are made from the original film and may be either contact (the same size) prints or enlargements, depending on the scale of the original film. Any computer-produced prints used in this report are generated from scans of the film at approximately 1,300 dots per inch (dpi) and printed at 720 dpi. Although the reproductions allow effective display of the interpretive annotations, they may have less photographic resolution than the original film. Therefore, some of the objects and features identified in the original image and described in the text may not be as clearly discernible on the prints in this report.

Study area boundaries shown in this report were determined from aerial photographs or collateral data and do not necessarily denote legal property lines or ownership.

Surface Drainage

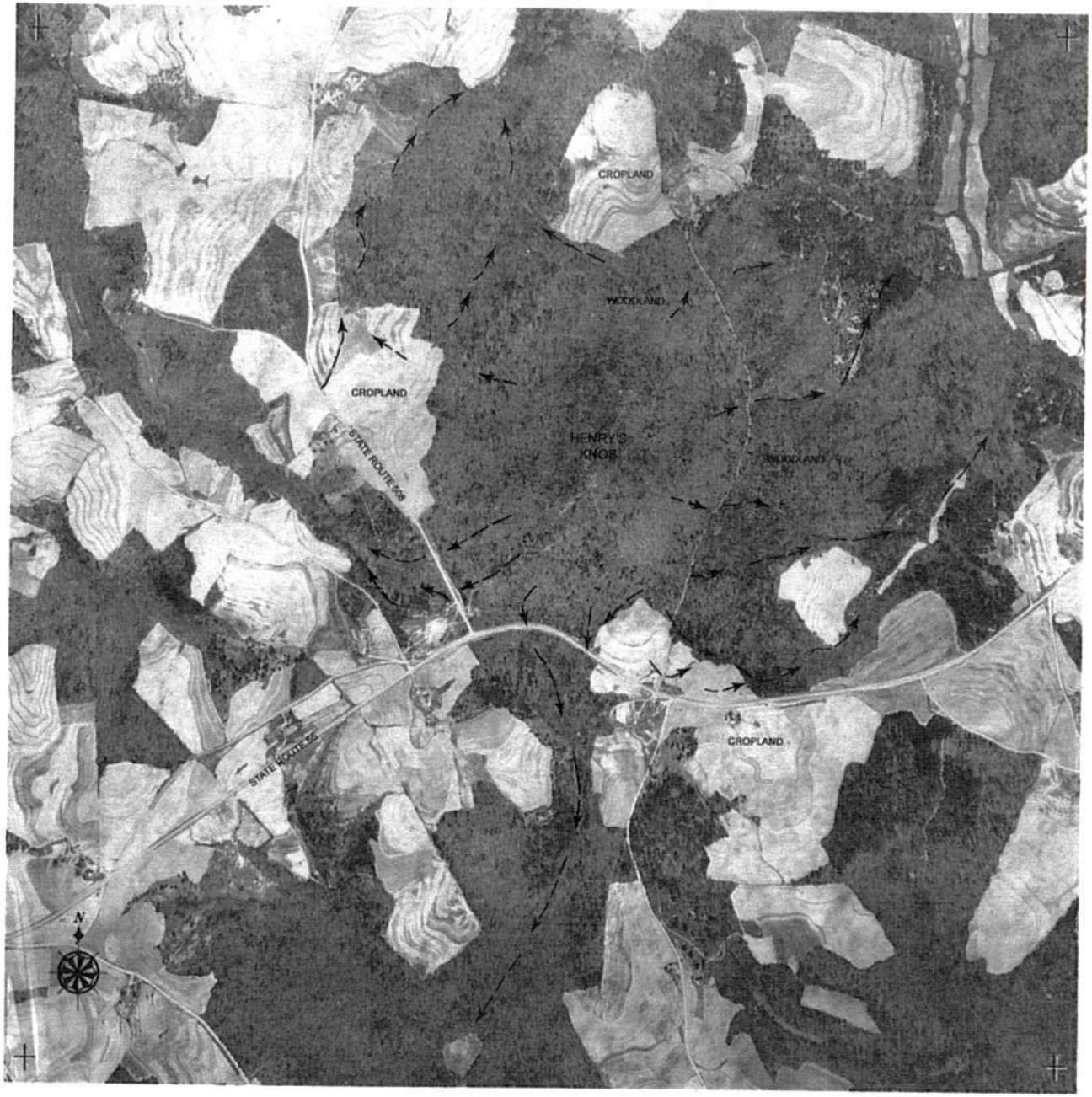
The surface drainage analysis produced for this report identifies the direction and potential path that a liquid spill or surface runoff would follow based on the topography of the terrain and the presence of discernible obstacles to surface flow. The analyst determines the direction of surface drainage by stereoscopic analysis of the aerial photographs and by examining USGS topographic maps. Site-specific surface drainage patterns are annotated on the map or photo overlay. Where the direction of subtle drainage cannot be determined, an indeterminate drainage line symbol is used. Regional surface flow is ascertained from the USGS topographic maps.

PHOTOGRAPHIC ANALYSIS

The Henry's Knob site, the location of a former kyanite mine and mill operation covers approximately 72.3 hectares (180 acres) and is situated approximately 0.8 kilometer (0.5 mile) north of State Route 55 and 0.8 kilometer (0.5 mile) east of State Route 508. The mine is situated in rural, rolling, terrain with hills and valleys. North of State Route 55, surface runoff from Henry's Knob reaches the South Fork Crowders Creek (see Figure 2). South of State Route 55, the surface runoff from Henry's Knob eventually reaches Allison Creek (not shown). The area land cover is mixed woodland with scattered areas of terraced cropland. Clover, South Carolina, is the nearest community and is located approximately 3.7 kilometers (2.3 miles) to the southeast.

APRIL 12, 1941 (FIGURE 3)

The 1941 photograph shows the condition of the site and the topography of Henry's Knob prior to the establishment of mining and milling activities. At the summit of Henry's Knob a rock escarpment (not annotated) is visible and the surrounding slopes of the knob are woodland. Areas of terraced cropland are visible to the north, south, and west of the rock escarpment. No excavation activity is discerned.



INTERPRETATION CODE

← — —	DRAINAGE
← ———	FLOW
====	VEHICLE ACCESS
IIIIIIIIIIII	BERM/DIKE
	EXCAVATION/PIT (EXTENSIVE)
	MOUNDED MATERIAL (EXTENSIVE)
B	BUILDING
C	CONVEYOR
EX	EXCAVATION
GS	GROUND SCAR
IM	IMPOUNDMENT
LT	LIGHT-TONED
M	MATERIAL
NB	NEW BUILDING
RV	REVEGETATED
SB	SUPPORT BUILDINGS
SL	STANDING LIQUID
SP	SPOIL PILE
TP	TAILINGS PILE
TR	TRENCH

Figure 3. Henry's Knob site, April 12, 1941. Approximate scale 1:10,800.

NOVEMBER 12, 1949 (FIGURE 4)

Mining operations are observed at the site. An unpaved access roadway trending to the northwest from State Route 508 has been constructed up the hillside of Henry's Knob and provides vehicle access to its summit. A visible ground scar (GS) reveals earthmoving and excavation activity at the north end of the rock escarpment. A spoil pile (SP), presumably consisting of the removed rock and soil overburden, has been deposited a short distance from an excavation area at the northern terminus of the access roadway.

A grouping of five mill buildings (B) (three of which are annotated) have been constructed along the southwestern slope of Henry's Knob. These mill buildings are situated at differing elevations on the terrain gradient. Within this mill complex, several of the buildings are connected by structures that are probable conveyors (partially annotated).

A vehicle roadway has been established into a remote area north of the mill buildings. The visible ground scars suggest that a probable impoundment (IM-1) is under construction at this location.

To the northwest and southeast of the mill complex, a visible cleared corridor cutting through the woodland indicates that probable utility lines now serve the mill complex at Henry's Knob. This probable utility line and corridor will no longer be annotated or discussed, unless features or activities of environmental significance associated with are discerned.

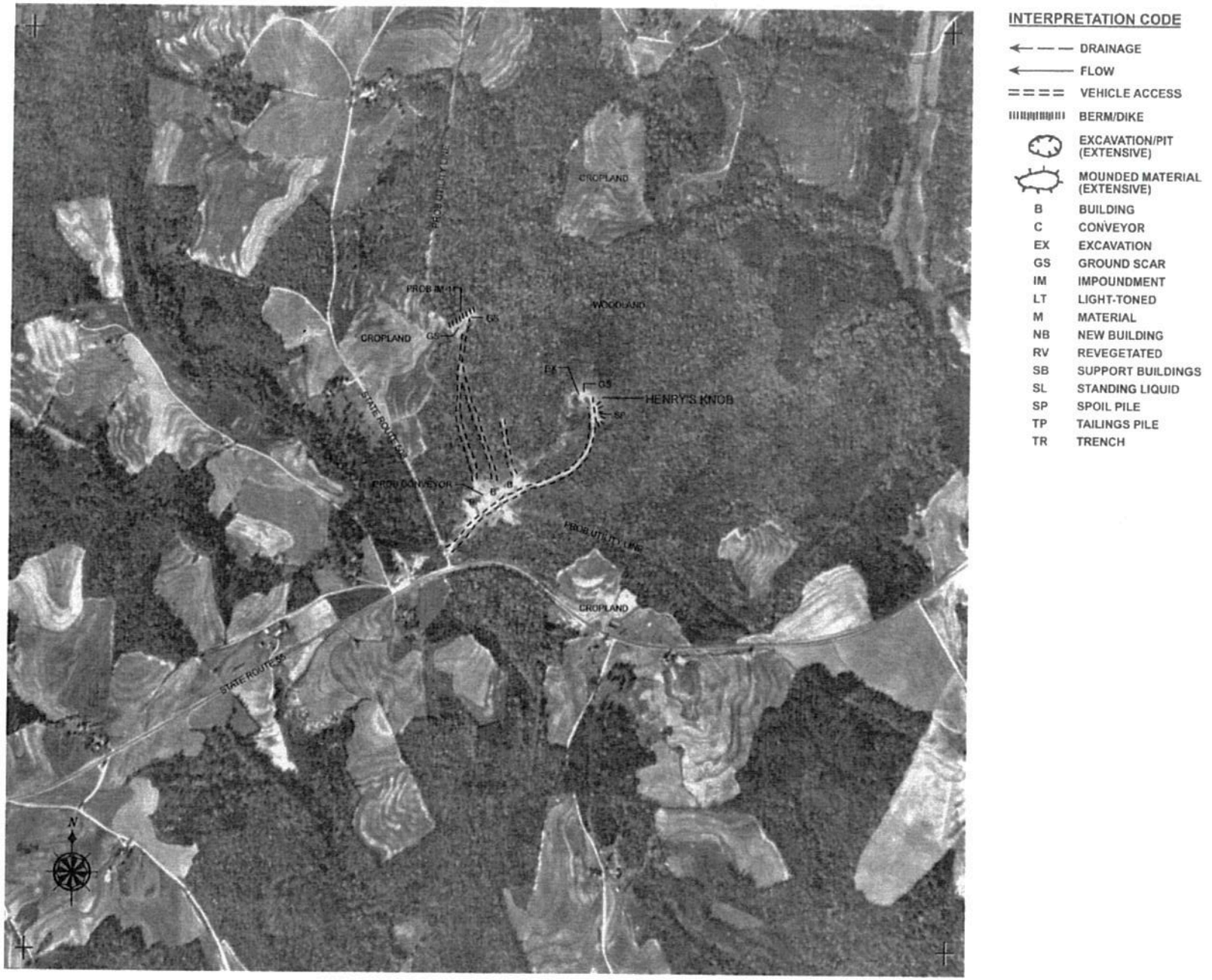


Figure 4. Henry's Knob site, November 12, 1949. Approximate scale 1:11,200.

APRIL 19, 1954 (FIGURES 5 AND 6)

A photographic enlargement has been provided to better show details of features of environmental concern at the Henry's Knob site. A square-box annotation on Figure 5 delineates the area that has been photographically enlarged as Figure 6.

The mining and milling operations have continued at the site since 1949. An excavated, open pit mine is now visible along the summit of Henry's Knob. The access roadway now encircles the summit and provides access to the open pit mine from both the northeast and southwest. Two light-toned spoil piles have been deposited short distances from the open pit mine, one along the north and the other on the southeast slope of Henry's Knob. A smaller excavation has also been dug to the south of the open pit mine.

Southwest of the open pit mine a total of nine mill buildings and five support buildings (SB) are now observed within the mill complex. A probable trench (TR) is observed at the north end of the mill complex. The function of this probable trench could not be determined, however. Typically gravity is used to transport ore through the stages of the milling processing. The mill buildings appear to conform to this layout design, as several of them are connected by a conveyor system (C), aligned downgradient from one another.

The construction of impoundment IM-1 has been completed downhill from and northwest of the mine pit. This impoundment contains light-toned material (LTM), which evidently has been transported by runoff, as no pipes or other conveyance system are discerned leading to the impoundment. Two roadways are observed linking this impoundment to the mill complex to the south.

A large, light-toned probable tailings pile (TP) has been deposited downhill and northwest from the mill complex. A second large impoundment (IM-2) has been built downgradient from this tailings pile just along the east side of Route 508. Impoundment IM-2 contains the light-toned probable tailings (mentioned above) and standing liquid (SL) presumed to be surface water runoff.

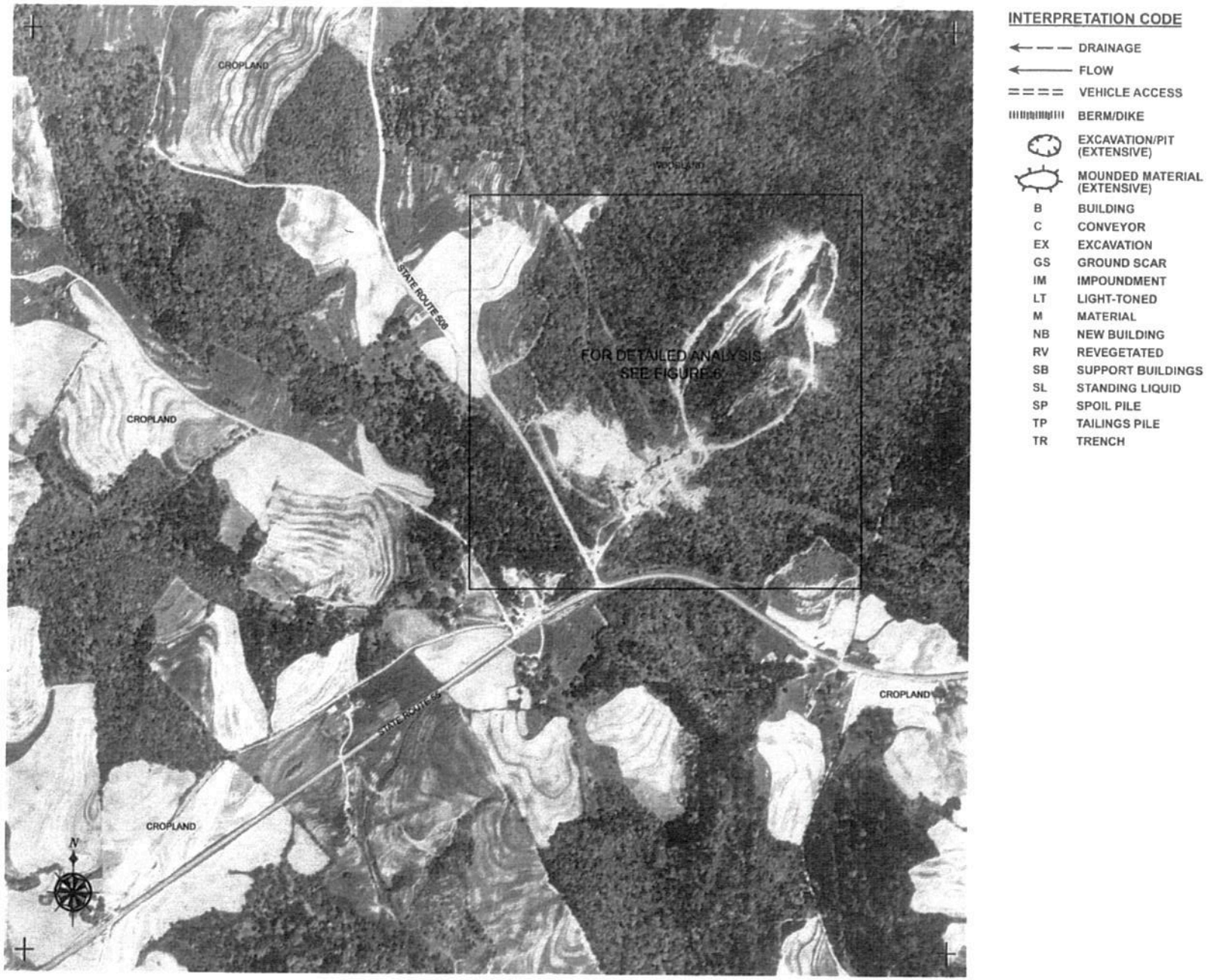


Figure 5. Henry's Knob site, April 19, 1954. Approximate scale 1:7,300.

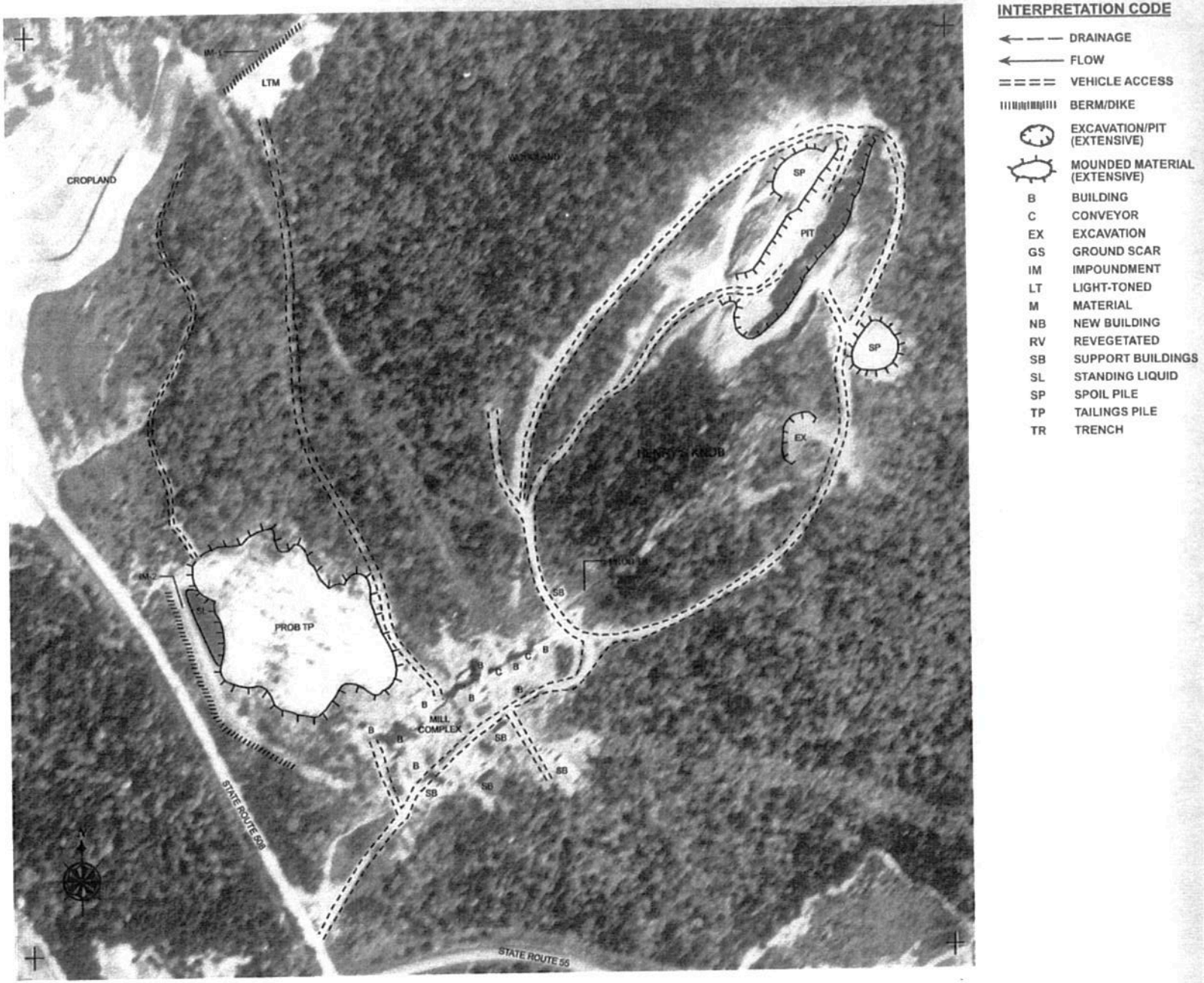


Figure 6. Henry's Knob site, April 19, 1954. Approximate scale 1:2,800.

APRIL 3, 1959 (FIGURE 7)

The 1959 photo figure and the subsequent photo figures have been photographically enlarged to show only those portions of the site in which features and activities of environmental significance could be discerned.

Excavation activity has expanded the size of the open pit mine. This excavation has altered the shape of Henry's Knob terrain and has resulted in the deposition of several large, light-toned spoil piles along the outer rim of the pit.

There are no significant changes noted at impoundment IM-1 which continues to contain light-toned material.

Within the mill complex two new buildings (NB) and three conveyors (C-1, C-2, and C-3) are discerned. These conveyors appear to be for the transport of material to mill piles situated on the north side of the mill complex. These piles presumably contain crushed ore or mill tailings. To the west the large probable tailings pile located within impoundment IM-2 is linked to conveyor C-1. This deposit has been expanded in size since 1954. To the west the adjacent area of standing liquid continues to be visible.

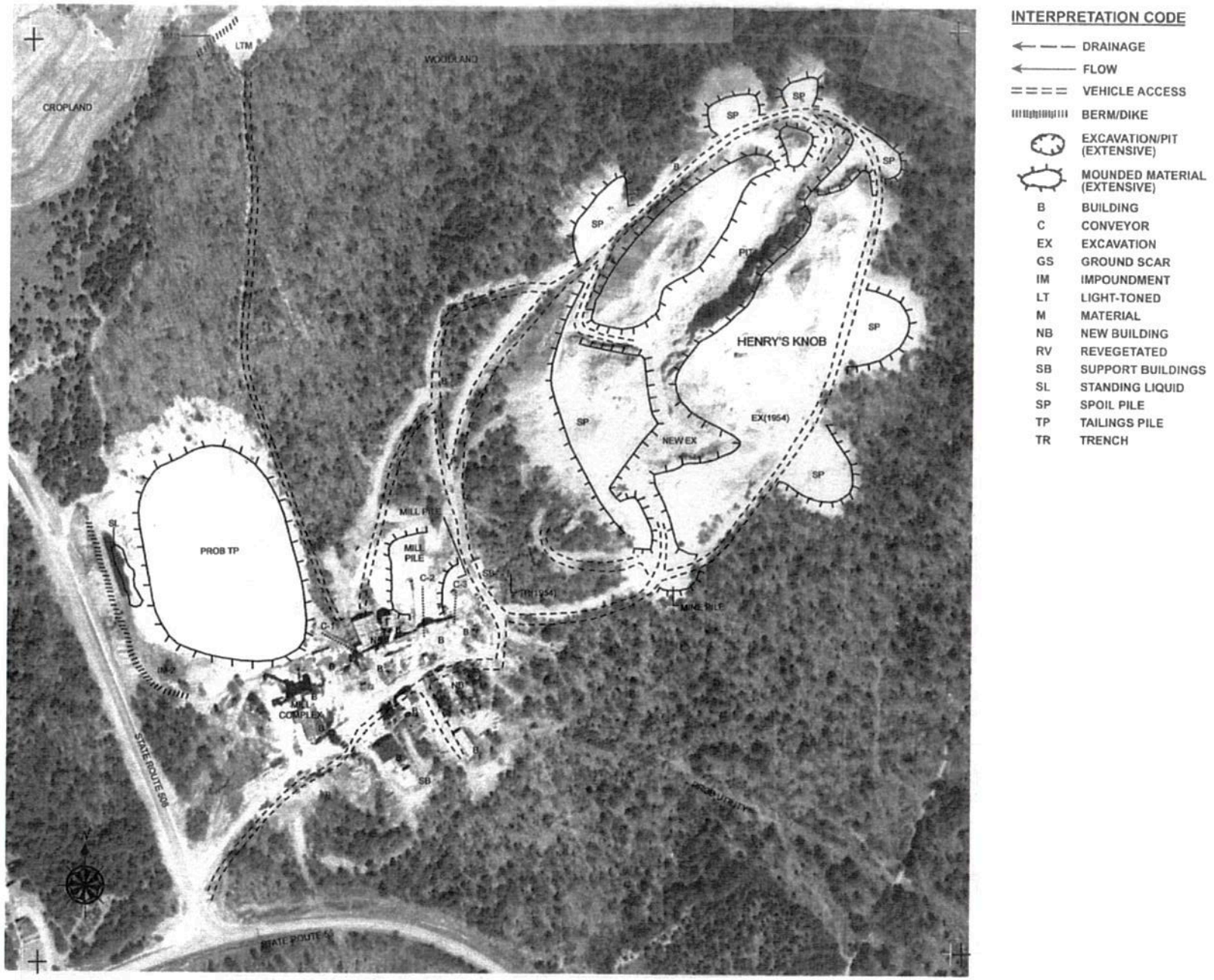


Figure 7. Henry's Knob site, April 3, 1959. Approximate scale 1:2,800.

NOVEMBER 21, 1964 (FIGURE 8)

Excavation activity within the open pit mine has continued since 1959. Several new access roads serve the mine pit which has been enlarged to the south and encompasses the entire summit of Henry's Knob. With the ongoing excavation activity within the mine, the number and size of the spoil piles deposited along the rim of the mine have also increased. Dark shadows (not annotated) obscure the base of the mine pit and preclude discerning features in this area.

No new construction or dismantling of buildings is apparent within the mill complex since 1959 (structures not annotated). However, the conveyors previously noted at the mill are not evident (not annotated).

The volume of the probable tailings deposit has been increased with the expansion of the containment berm of impoundment IM-2. The enlarged IM-2 now extends north and has become contiguous with impoundment IM-1. New impoundment IM-3 has been constructed on the north side of impoundment IM-1 and contains light-toned material, which is evidently overflow of material from impoundment IM-1.

Two breaches are indicated by erosion rills along the north face of containment berm of impoundment IM-1. Runoff passing through these breaches appears to flow into recently constructed impoundment IM-4 that spans a valley downhill from impoundment IM-1. A new access road runs along the north side of Henry's Knob and was presumably used during the construction of impoundment IM-4. Currently light-toned material (probable tailings) and standing liquid are visible within impoundment IM-4. A spillway has been built within the rim of the containment berm that forms impoundment IM-4. Potential drainage leaving impoundment IM-4 would enter the natural drainage system in the valley below and, thus, could threaten the South Fork Crowders Creek.

Another new, large impoundment (IM-5) has been constructed downgradient from impoundment IM-2 on the west side of Route 508. Impoundment IM-5 contains standing liquid and light-toned material (probable tailings). Tailings transported by runoff could escape impoundment IM-2 from a breach located in the southwestern portion of the containment berm. The drainageway passes west

through a culvert under Route 508 near the northwestern corner of IM-2. There appears to be a spillway constructed along the northeast edge of the berm forming impoundment IM-5. Potential liquid draining from impoundment IM5 would enter the valley and the natural drainage system to the northwest and could threaten the South Fork Crowders Creek.

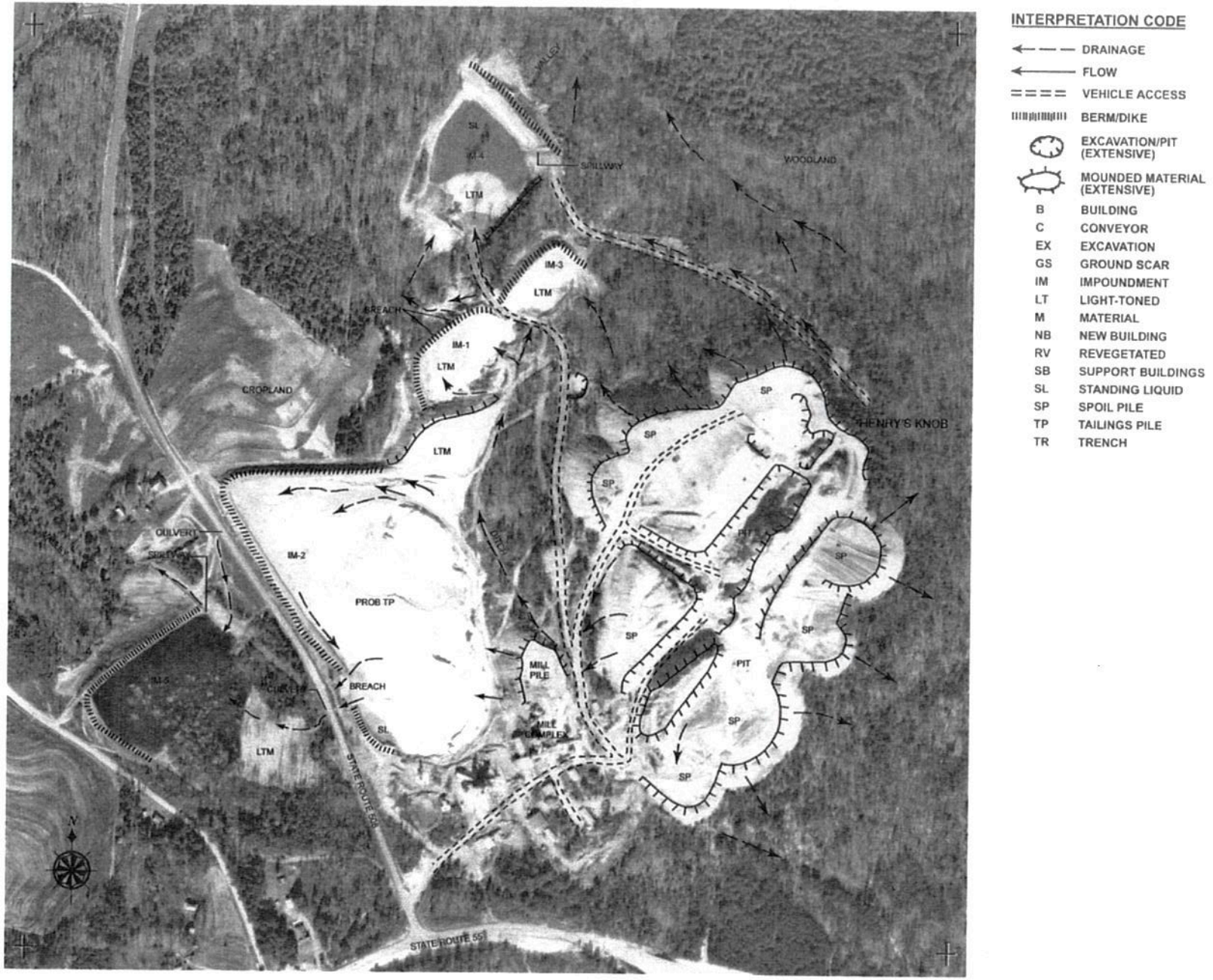


Figure 8. Henry's Knob site, November 21, 1964. Approximate scale 1:4,000.

FEBRUARY 20, 1970 (FIGURE 9)

The mining and milling activities at the Henry's Knob site have continued. The size of the open pit mine has been expanded since 1964 and the size of the spoil piles have also increased along both the north and south outer rims of the mine. A new impoundment (IM-6) has been constructed on the north side of the Henry's Knob. At the south side of Henry's Knob, a new spoil pile has been deposited to the east of the mill complex, near the north side of Route 55.

In the northern portion of the site, impoundment IM-4 continues to retain light-toned material; however, the standing liquid noted in 1964 is not evident. Impoundment IM-4 appears to capture runoff from impoundments IM-1 and IM-3. Potential liquid draining from impoundment IM-4 via the spillway would enter the natural drainage system and could threaten the South Fork Crowders Creek.

Within the mill complex no new construction or dismantling of buildings (structures not annotated) is apparent since 1959, and all of the mill buildings appear operational. The conveyor C-1 appears to be present, but has been repositioned since 1959. The other previously noted conveyors are not evident. Erosion rills are visible within the mill complex and a small impoundment (not numerically designated), which contains standing liquid, has been built at the south end of the mill complex and evidently captures runoff.

To the north deep erosion rills are visible in the probable tailings within impoundment IM-2 and large breaches are visible in the containment berm of this impoundment. Drainage patterns reveal runoff flows west from impoundment IM-2 and enters impoundment IM-5 located on the west side of Route 508. The light-toned material observed within impoundment IM-5 is probable tailings. The standing liquid observed within impoundment IM-5 on the 1964 photograph is no longer discerned.

Another new impoundment (IM-7) has been constructed within the same valley and downgradient from where impoundment IM-5 is situated and has flooded the valley behind it. Impoundment IM-7 contains both standing liquid and light-toned material; trees are still visible standing in this impoundment. Drainage patterns indicate runoff would overflow impoundment IM-5 via a spillway and could enter impoundment IM-7. Any potential overflows (not annotated) from impoundment IM-7 would enter the valley, and flow into the natural drainage system before eventually threatening the South Fork Crowders Creek.

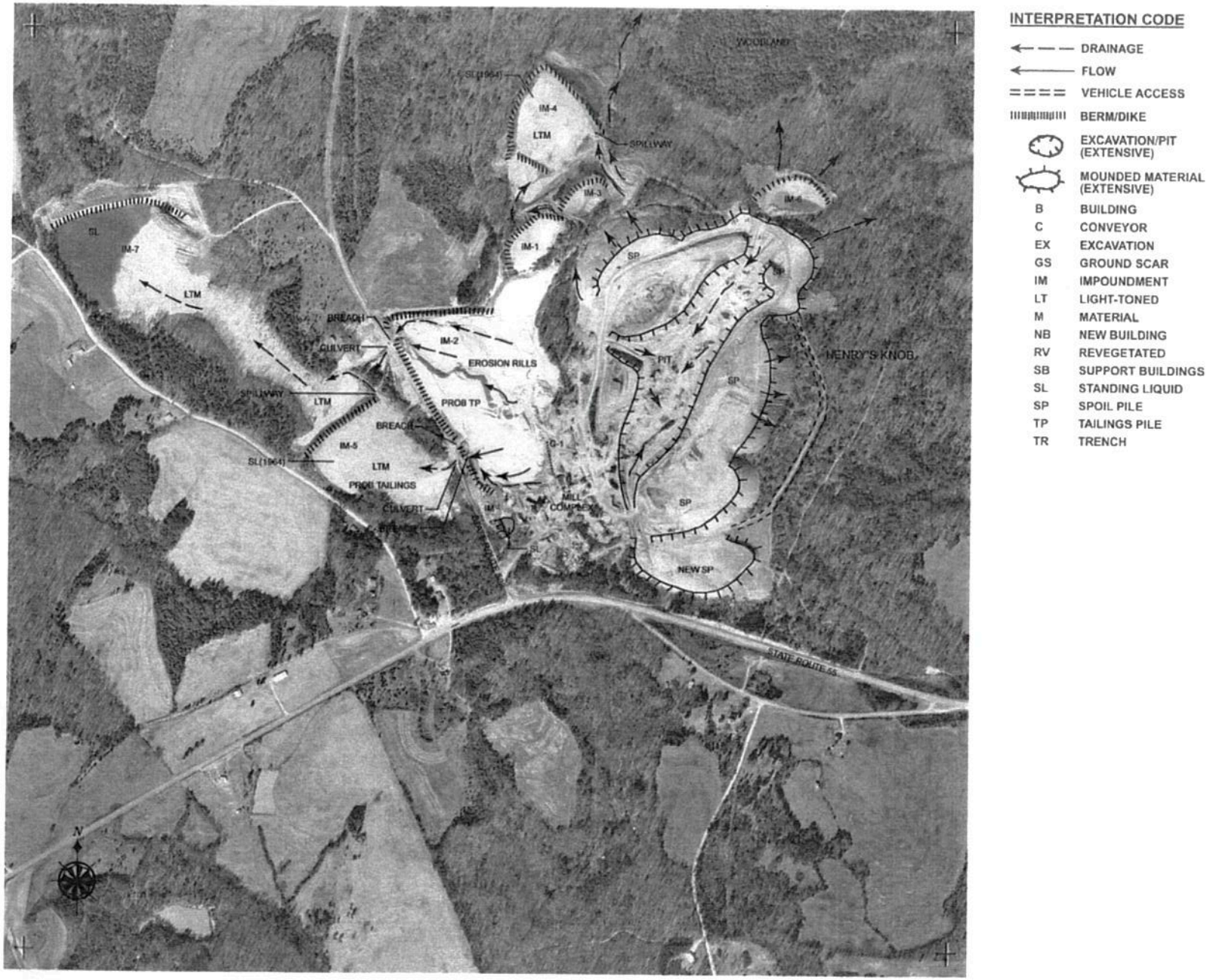


Figure 9. Henry's Knob site, February 20, 1970. Approximate scale 1:7,500.

MAY 28, 1981 (FIGURE 10)

The mining and milling operations at the Henry's Knob site are no longer active. All mill buildings and structures noted in the 1970 photograph have been dismantled and removed and only building foundations remain. Ground scars and vehicle roadways (features not annotated) are also visible throughout former mill complex as well as in the inactive open pit mine. The open pit of the former mine is now partially flooded. The large spoil piles noted along the outer rim of pit mine have been abandoned in place. Most of these spoil piles have become partially revegetated (RV).

To the northwest of Henry's Knob, impoundment IM-4 still contains light-toned material that is devoid of vegetation, while the former impoundment IM-6 north of the mine pit is no longer discernible and is overgrown with vegetation (not annotated). The spoil piles more recently deposited on the north side of the former impoundment IM-6 have only sparsely revegetated.

Erosion rills (not annotated) remain visible on the light-toned probable tailings deposit within impoundment IM-2. The light-toned material visible within most of the impoundments IM-1 through IM-7, which are probable tailings transported by runoff, generally appears to be devoid of vegetation. The visible breaches in the containment berms of impoundments IM-2 and IM-5 suggests tailings have migrated from impoundment IM-2 to impoundment IM-7. On the west side of Route 508, downgradient from impoundment IM-5, a new impoundment (IM-8) has been constructed adjacent to impoundment IM-7. This new impoundment appears to capture additional runoff draining from the northwest side of Henry's Knob.

In the southeastern corner of the site, another new impoundment (IM-9) has been constructed. This impoundment captures runoff draining from the east side of Henry's Knob, particularly from the spoil piles on the southeast side of the mine rim.

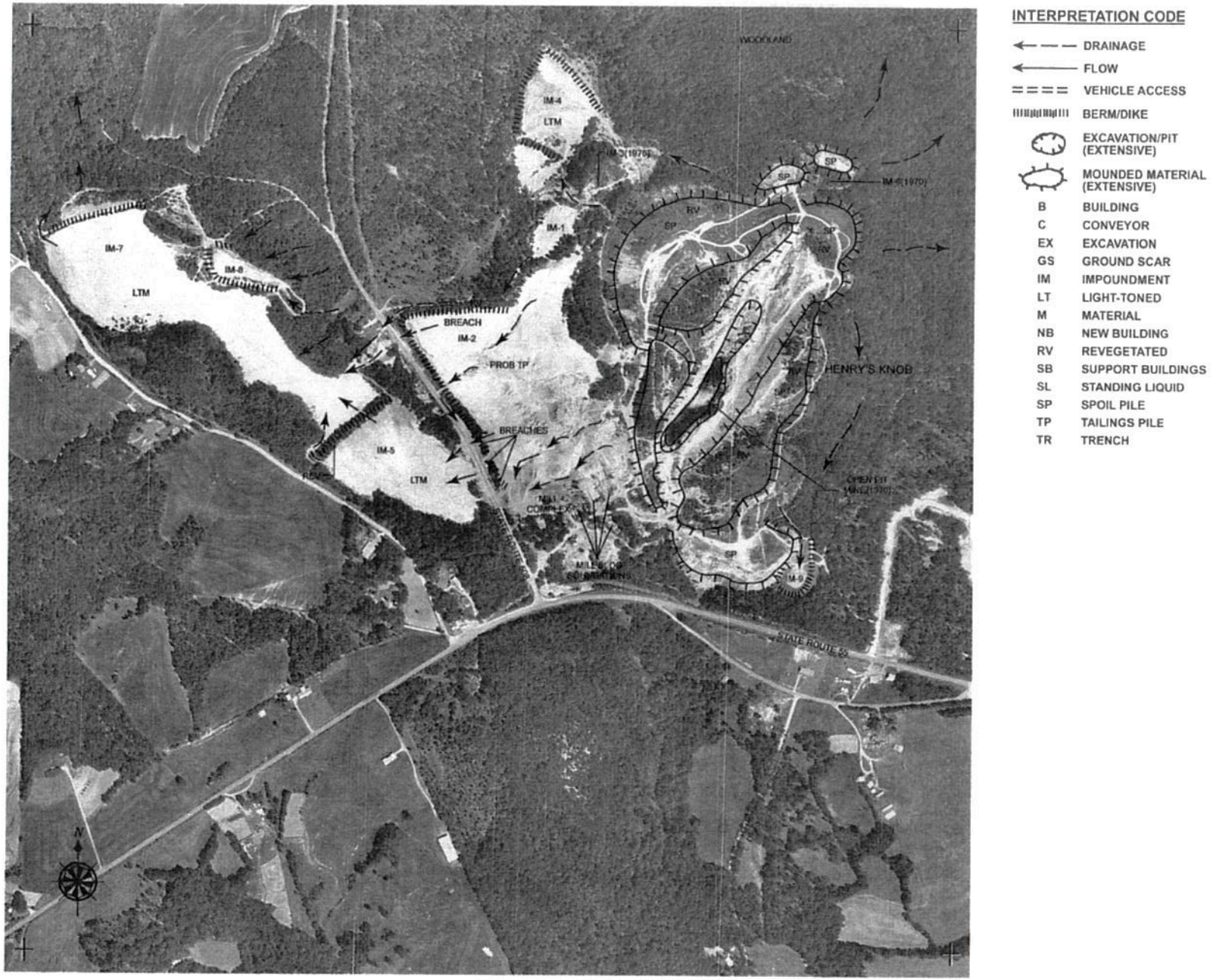


Figure 10. Henry's Knob site, April 28, 1981. Approximate scale 1:7,500.

GLOSSARY

Access Road - A paved or unpaved route of vehicular access.

Berm/Dike - An embankment of either natural or man-made materials that impounds liquids, solids or other materials, or controls flood waters.

Building (B) - A relatively permanent, essentially boxlike construction having a roof.

Dark- (DT), Medium- (MT), or Light-Toned (LT) - Tones of features in question are compared with the darkest and lightest tones of gray (if using B&W photography) on the print.

Ditch - A long narrow excavation, as for draining or irrigating land.

Excavation Area (EX) - An area where earth or other material is being removed in order to alter the ground level (e.g., building construction).

Ground Scar (GS) - An area of bare soil, apparently the result of human activity.

Impoundment (IM) - A liquid containment area that appears to be related to activity on a site.

Material (M) - Raw or waste materials on or in the vicinity of the site.

Spoil - Earth and rock excavated or dredged, as with surface mining, road construction, and harbor dredging.

Standing Liquid (SL) - A small, shallow, temporary collection of liquid, not necessarily waste.

Tailings - Residue of raw materials or wastes separated out during the processing of mineral ores.

Trench (TR) - A long, narrow excavation unrelated to drainage.

REFERENCES

MAPS

Source[a]	Figure	Name	Scale	Date
USGS	1	United States	1:2,500,000	1972
USGS	2	Filbert, SC	1:24,000	1971
USGS	2	Kings Mountain, SC	1:24,000	1977

COLLATERAL INFORMATION

EPA. 2003. Collateral data and site map supplied by EPA Region 4 as attachment to Remote Sensing Services Request Form.

LMS (Lockheed Martin Services). 2002. Master Quality Assurance Project Plan. Prepared for EPA Environmental Sciences Division. Contract 68-D-00-267. Las Vegas, Nevada.

HPCPNH. 2002. Hilton Pond Center for Piedmont Natural History: http://www.hiltonpond.org/ArticleMineralsSCMain.html. January 2003.

AERIAL PHOTOGRAPHS

Photo source[a]	Figure[b]	Date of acquisition	Original scale	Film type[c]	Mission I.D.	Source frame #	EPIC ID #
KVT	3	04-12-41	1:20,000	B&W	RG145	8B05	81434
USGS	4	11-12-49	1:57,000	B&W	VVAJM7	506	-
KVT	5,6	04-19-54	1:20,000	B&W	RG145	128	81436
USGS	7	04-03-59	1:20,000	B&W	PL	47	81578
KVT	-	02-08-60	1:48,500	B&W	RG373	39	81439
USDA	8	11-26-64	1:20,000	B&W	PL	43	81577
USDA	9	02-20-70	1:20,000	B&W	PL	88	81572
USDA	10	04-28-81	1:40,000	B&W	45091	93	81568
USDA	-	05-13-81	1:24,000	CIR	UNK	2369:67,75	-

[a] KVT King Visual Technology, Hyattsville, Maryland
USDA U.S. Department of Agriculture, Salt Lake City, Utah
USGS U.S. Department of Interior, U.S. Geological Survey, Washington, D.C.

[b] Photographs listed with no figure number were analyzed but not placed in this report because no significant features or changes had occurred since the previcus photographs

[c] B&W Black-and-white
CIR Color Infrared